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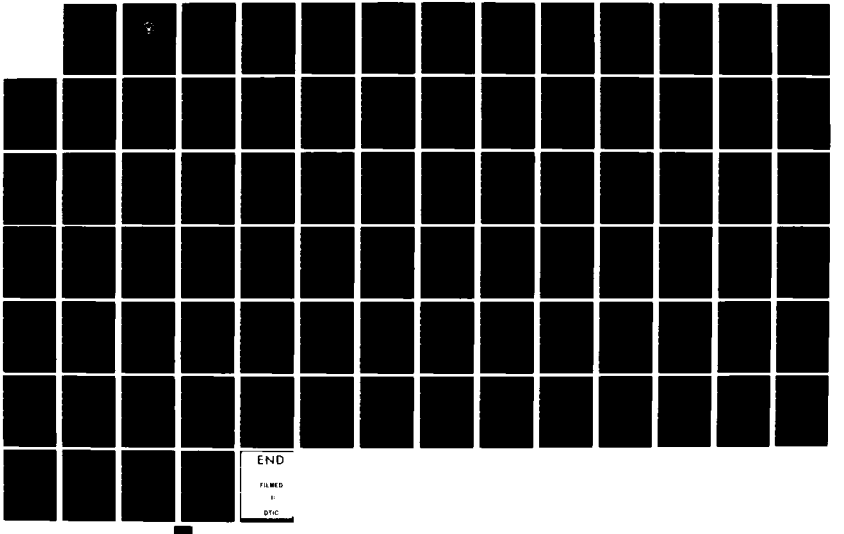

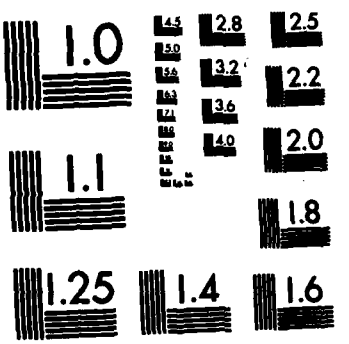

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

A COMPARISON OF MANNING OPTIONS FOR
THE AO-177 CLASS FLEET OILER

by

Jeffrey Lee Flood

October 1982

Thesis Advisors: D. C. Boger
M. G. Sovereign

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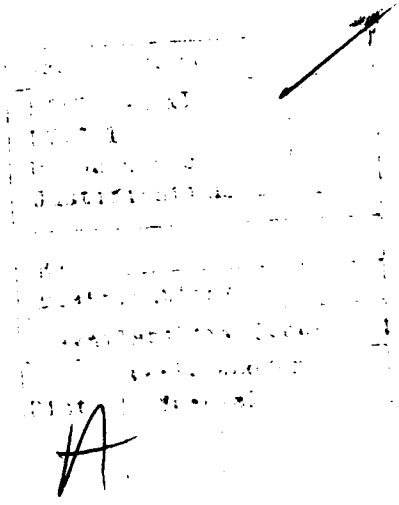

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A Comparison of Manning Options for the AO-177 Class Fleet Oiler

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This study develops comparative life cycle costs for the Navy military and Navy military-conversion to civil service manning options for the AO-177 class fleet oiler. These life cycle costs were derived by discounting the total annual cost elements of personnel, operations, and maintenance over thirty years using mid-year discount factors corresponding to a ten percent discount rate. In addition to the life cycle cost analysis, the non-quantifiable factors of Navy fleet oiler force level requirements, the expected recruiting environment in the 1980's, and the requirement for a training platform for the multi-product AOE/AOR replenishment station ships were presented and discussed. Conclusions were drawn based upon the cost and non-quantifiable factor analysis and recommendations concerning the manning of the AO-177 class fleet oilers, future fleet oiler manning, and possible further research were presented.

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I. INTRODUCTION

A. BACKGROUND

In 1978, commenting on a 1978 General Accounting Office (GAO) report on fleet oilers (AO's), the Chief of Naval Operations (CNO) stated that the Navy was converting all fleet oilers to civilian manning and that all future AO's would be built for civilian crews. Since 1972 the Navy has been converting some of the older AO's to Military Sealift Command (MSC) Navy civil service manning for extended service as part of the Navy Mobile Logistics Support Forces (MLSF). The FY 75 ship construction plan provided for the construction of five ships of a newly designed AO-177 class fleet oiler which was to be an austere, minimum-manned oiler with a 120,000 barrel cargo capacity. These five ships have been built for military manning. In May 1980 the Naval Audit Service recommended that the AO-177 class fleet oilers be converted to civilian manning at their first scheduled overhaul [Ref. 1]. Faced with this recommendation from within, the Navy must decide if it can realize significant annual budget and life cycle cost savings by such a conversion while still retaining the operational capabilities of a Navy manned oiler.

B. STATEMENT OF THE PROBLEM

Any decision concerning the manning options of the AO-177 class fleet oiler will be greatly influenced by the quantifiable cost comparison of the manning options considered. The problem then is to determine what level of MSC naval civil service or Navy military manning is required for the AO-177 class fleet oiler to fulfill the required operational capabilities of that class ship. Given those manning levels, the question is whether significant life cycle cost savings can be realized if the ship were to be converted from Navy military to MSC civil service manning.

C. OBJECTIVES OF THE ANALYSIS

The objective of this analysis will be to develop comparable life cycle costs associated with the military and civil service manning options for the AO-177 class fleet oiler to determine if significant cost savings can be realized by conversion of the AO-177 class fleet oiler to civil service manning. The civilian contract manning option will not be analyzed as the Navy has revealed substantial concern about contract manning of its ships. On 5 March 1981 a naval representative appearing before the Senate Armed Services Committee was asked if either MSC or the Navy had experienced problems with "the contractor operations for the tanker ships which would not have occurred if the ships were manned by civil service personnel." The naval representative stated

that MSC had experienced problems, saying that "in every instance where a contract has been let to a new operator with different union affiliations than that of a previous operator, the unions affiliated with the previous operator have attempted unsuccessfully to upset the procurement action and on occasion, to disrupt the operation of the tankers" [Ref. 2]. It is because of these difficulties which MSC has experienced that the Navy is reluctant to man its fleet support ships with civilian contract personnel.

D. CONTENTS

The following chapter of this thesis will briefly discuss two pertinent studies which deal with civilian manning of Navy ships, The Investigation of the Potential for Increased Use of Civilian Manning in Fleet Support Ships, (CIVMAN), and the Analysis of a Study Entitled Civilianization of Navy Fleet Support Ships Prepared for the Joint Maritime Congress, (CIV 77). Both studies were performed by Information Spectrum, Inc. Chapter III will state the projected operational environment (POE) and briefly discuss the required operational capabilities (ROC's) of the AO-177 class fleet oiler. Given these required capabilities, the Navy and civil service manning levels necessary to meet these requirements will be stated. Chapter IV will develop annual personnel costs for each manning option, and then total annual costs will be developed to include personnel, operations, and

maintenance costs. The cost of reconfiguration for civilian manning will apply to the civil service manning option only. The annual costs developed will then be discounted over thirty years to determine life cycle costs for each manning option. Appendix A complements Chapter IV in that it shows the detailed derivation of the Navy and military detachment billet costs. In Chapter V sensitivity analysis will be performed on those cost factors developed in Chapter IV which are most volatile. In addition other non-quantifiable factors which would weigh heavily in any manning decision will be examined in Chapter V. These factors are Navy fleet oiler force-level requirements to support carrier battle groups, the expected recruiting environment during this decade, and the requirement for a Navy-operated AO-177 to serve as a training platform for the multi-product AOE/AOR ships. Chapter VI will summarize this thesis and present conclusions and recommendations derived therefrom.

II. PREVIOUS ANALYSES

A. CIVMAN

The CIVMAN study, formally titled The Investigation of the Potential for Increased Use of Civilian Manning in Fleet Support Ships, was prepared for the Department of the Navy by Information Spectrum, Inc. and was released on July 17, 1978. The method of analysis used in this study was to evaluate the Navy civil service and the commercial contract manning alternatives to Navy military manning of fleet support ships with respect to manpower requirements, manpower costs, total ship operating costs, mission fulfillment capability, operating policy, risks, and total fleet and merchant marine labor market effects. Each manning alternative was evaluated in terms of those parameters to derive comparative information between current manning and operating policies and possible alternative future manning and operating policies for Navy fleet support ships. The CIVMAN analysis was done at a time of significant fiscal constraints and potential military manpower shortfalls and was one of several initiatives by the CNO which attempted to "redress the supply/demand problem in the context of total force manpower management" [Ref. 3: p. 1]. While it did not reach any conclusions, it did analyze the implications of the three manning alternatives both quantitatively and qualitatively and was therefore

considered the baseline for examining the increased use of civilian manning in the fleet.

B. CIV 77

In March 1980 the Joint Maritime Congress (JMC) released a report, in draft form only, formally titled "Civilianization of Navy Fleet Support Ships," which took issue with the findings of the CIVMAN study. At the request of the Department of the Navy, Information Spectrum then did a study formally titled Analysis of a Study Entitled Civilianization of Navy Fleet Support Ships Prepared for the Joint Maritime Congress, (CIV 77), which it published on December 15, 1980. The CIV 77 study found the JMC report wanting in its failure to consider the specific areas of ship mission, role, and manning philosophy when doing cost comparisons of manning alternatives for the ships concerned. The CIV 77 study also updated the CIVMAN report in that it estimated operating costs for the three manning options (Navy military, Navy civil service, and civilian contract) using reconstructed and updated manning plans for each option.

III. EFFECTIVENESS MODEL

A. REQUIRED OPERATIONAL CAPABILITIES

OPNAVINST 3501.134 dated April 21, 1980 [Ref. 5] promulgates the projected operational environment (POE) and required operational capabilities (ROC's) for the AO-177 class fleet oiler. The POE was established to develop organizational manpower requirements in the Preliminary Ships Manning Document (PSMD) for the AO-177 class fleet oiler [Ref. 4]. An at-sea, wartime environment is detailed where the capability to perform all defensive functions simultaneously while in Readiness Condition I, or to otherwise maintain continuous Readiness Condition III is necessary. Readiness Condition I is defined as all personnel being continuously alert, all possible operational systems being manned and operating, and no maintenance is expected except that which is routinely associated with watchstanding and urgent repairs. The maximum expected crew endurance at Condition I is twenty-four continuous hours. Readiness Condition III is defined as operational systems being manned and operating as necessary to conform to prescribed required operational capabilities, including accomplishment of all normal underway maintenance, support, and administrative functions. Opportunity for eight hours of rest per man per day exists in Readiness Condition III; the maximum expected

crew endurance in this condition is sixty continuous days [Ref. 4: p. 4]. The need to otherwise be able to conduct underway replenishment in support of operating forces by simultaneously providing petroleum product or other product support from five replenishment stations (for periods not to exceed thirty-two hours per week) is established as well as the need to be able to conduct vertical replenishment of operating forces. Additionally, the crew must be able to perform all maintenance for which it is responsible.

The required operational capabilities for the AO-177 class fleet oiler are defined by mission areas. These mission areas are Mobility, Command and Control and Communications, Anti-Air Warfare, Anti-Surface Warfare, Logistics, Fleet Support Operations, Non-Combat Operations, and Intelligence [Ref. 5: Encl. 1, 2]. The ROC's will not be enumerated in this analysis; however, individual ROC's will be referenced in the determination of manpower requirements for the two manning options being considered.

Effectiveness will be fixed in this analysis by the ROC's of the AO-177 class fleet oiler. Once the Navy and civil service manning levels required to fulfill the ROC's are determined, the minimum life cycle cost manning option will be derived.

B. MANNING ALTERNATIVES

1. Navy Military Manning

The Navy military manning analysis is based on the organizational requirements developed by the Preliminary Ships Manning Document (PSMD) for the AO-177 class fleet oiler, dated 18 January 1980 [Ref. 4]. It will be assumed that the AO-177 will be manned to the PSMD level, although most naval ships are manned to a level lower than this.

2. Navy Civil Service Manning

The initial manpower requirement estimates for Navy civil service manning were obtained from the CIVMAN study. Information Spectrum, Inc. used Military Sealift Command manning estimates based on the MSC analysis of tasks required to ensure mission performance and ship maintenance in a peacetime environment. These estimates include both the civil service personnel and military detachments (Mildet) required for ship operation. These military detachments carry out those functions deemed inappropriate for accomplishment by civil service personnel. For the purposes of this analysis the MSC estimates will be adjusted to meet manpower requirements to fulfill all ROC's of the AO-177 class fleet oiler.

C. MANPOWER REQUIREMENTS ANALYSIS

1. Navy Military Manning to PSMD

The PSMD delineates, by individual billets, total manpower requirements essential to the performance of assigned

mission areas and required operational capabilities prescribed for a fully ready unit. These manpower requirements are predicated upon the mission, operating profile, configuration, and computed workload for a Navy manned AO-177 class fleet oiler. The Manpower Summary for the Navy military manned AO-177 class fleet oiler, as contained in the PSMD, is shown in Table I. Appendix A shows the grade, rate, and rating breakdown of each department.

2. Navy Civil Service Manning

As previously stated, the Military Sealift Command manpower estimates were used in this analysis to determine manpower costs. For the purposes of this analysis the only adjustment made to the MSC manpower estimate was the addition of seven Operations Specialists to the military detachment so that the Command and Control and Communications, Anti-Air Warfare, Anti-Surface Warfare, and Intelligence mission area capabilities of the Navy manned and civil service manned AO-177 class fleet oiler would be equal. Based upon bridge watchstander, replenishment station, and cargo control manpower requirements, it has been determined through informal conversations with personnel in OPNAV 375 that the civil service manned AO-177 class fleet oiler is capable of performing all required operational capabilities given the civil service manning level proposed by MSC. The civil service (plus Mildet) manpower summary is shown in Table II.

TABLE I

Navy Military Manpower Summary

Major Organizational Component	Officer	Enlisted
Executive Department	2	9
Navigation Department	1	6
Operations Department	2	24
Deck Department	2	55
Engineering Department	3	64
Supply Department	2	28
	12	186

[Ref. 4: p. II-1]

TABLE II

Civil Service (Plus Mildet) Manpower Summary

Division	Licensed*	Unlicensed*	
Deck	6/1**	31/1**	
Engine	5/0	17/0	
Steward	0/0	22/0	
Purser	0/0	7/1**	
Medical	0/0	1/0	
Communications	0/0	0/16**	
CIC	0/0	0/7**	(1)
Repair	0/0	0/0	
	11/1**	78/25**	

* Licensed personnel are the ship's officers that have been examined and licensed by the United States Coast Guard. Unlicensed personnel have demonstrated practical skills to Coast Guard observers and have been issued a card authorizing them to serve in particular capacities aboard ship.

** Denotes Mildet.

(1) Added to initial MSC estimate for this analysis.

[Ref. 3: p. A-8]

IV. BASELINE COST ANALYSIS

The life cycle costs for the Navy military and civil service manning options for the AO-177 class fleet oiler will be derived in three stages using FY 81 dollars as the base for all cost computations. FY 81 dollars have been utilized because the latest Navy Billet Cost Model available for this study was computed using the FY 81 pay rates for naval personnel. Initially, annual personnel costs will be computed for each manning option. These annual personnel costs will then be combined with operations and maintenance costs for each manning option to derive total annual costs. In the case of the Navy military manning option, the total annual costs will be discounted over thirty years to derive life cycle costs. In the case of the civil service manning option, it will be assumed that conversion to civil service operation will take place after four years operation as a naval vessel. It will also be assumed that the conversion will take one year to complete. This assumption is based upon a reconfiguration estimate of 12-15 months made by OP-375D personnel in 1980 [Ref. 13]. During this year only the costs of reconfiguration will be included in the life cycle costing for reasons to be discussed later in this chapter.

Given the assumptions discussed in the previous paragraph, the total annual costs of Navy military operation will be discounted over the initial four years of the oiler's life and then added to the total annual costs derived for the civil service manning option discounted over twenty-five years. To these figures will be added the discounted cost of reconfiguration to derive the total Navy military-conversion to civil service manning life cycle costs. All discounted costs will be derived using mid-year factors corresponding to a discount rate of ten percent.

The life cycle cost computations which will be illustrated in this chapter, while detailed, can only be considered approximate, partly due to the inherent weaknesses of the costing data sources. The primary sources of the baseline costing data are the 1979 Navy Program Factors Manual, the FY 81 Navy Billet Cost Model and the CIVMAN and CIV 77 studies. The 1979 Navy Program Factors Manual is presently almost three years old and is currently under revision at the Office of the Chief of Naval Operations (OP-90). The FY 81 Navy Billet Cost Model is currently under revision at the Navy Personnel Research and Development Center. Informal conversations with a representative of that organization indicate that the model is being updated to reflect the substantial military pay increase of FY 82 and other inadequacies which tended to understate billet costs

associated with Navy personnel. As these two documents were the primary sources for the Navy military personnel, operations, and maintenance costs for the AO-177 class fleet oiler, it must be recognized that the life cycle costs of the Navy military manning option may be somewhat understated.

The same can be said of the Navy military-conversion to civil service manning option life cycle costs to be derived in this study. The Navy civil service personnel costs will be derived primarily by using personnel cost category data from the CIVMAN study. Informal conversations with a representative of the Military Sealift Command comptroller's office indicate that the MSC cost category data furnished to Information Spectrum for the CIVMAN study was based upon a specified MSC AO-177 class fleet oiler operating profile equal to that of a Navy-operated oiler of that class. Actual operating profiles of MSC civil service manned oilers, however, have been higher than Navy military manned oilers indicating that the civil service personnel costs included in the CIVMAN study may be understated.

A life cycle cost comparison is a necessary part of any manning option decision concerning the AO-177 class fleet oiler. A detailed baseline cost of both manning option life cycle costs will therefore be derived in this chapter. The inherent weaknesses of the baseline costing data is recognized, however, and therefore not only will life cycle cost sensitivity to varying cost elements be conducted in Chapter V, but

also non-quantifiable factors which would weigh heavily in any manning decision for the AO-177 class fleet oiler will be examined in that chapter.

A. ANNUAL PERSONNEL COSTS

1. Navy Military Manning to PSMD

The annual military personnel cost represents the annual cost associated with manning the AO-177 class fleet oiler to the PSMD level in the Navy military manning option. This cost includes both those billet costs of manning particular positions with given ratings and paygrades, and the other indirect personnel costs of base operations support (BOS), and logistics support. For this analysis the FY 81 Life Cycle Billet Costs for both officer and enlisted personnel were used to derive the annual total billet costs of manning the AO-177 class fleet oiler to PSMD level. The cost elements included in the Navy Billet Cost Model for both officer and enlisted personnel are shown in Figure 4.1. The indirect costs of base operations support and logistics support for the AO-177 class fleet oiler were obtained from the 1979 Navy Program Factors Manual in FY 81 dollars.

To derive the annual Navy military personnel costs the billet costs by grade and rating were applied to the number of personnel of each grade and rating found in the PSMD for the AO-177 class fleet oiler. The indirect costs of base operations support and logistics support were added

OFFICER BILLET COST ELEMENTS:

Base Pay
Medical/Veterinarian Pay
Command and Administration
Overseas Station Allowance
Death Gratuity
Dental Pay
Dependent School
Incentive/Continuance Pay
Family Separation Allowance
FICA
Severance/Readjustment Pay
Insurance/Housing (FHA)
Medical Costs
Clothing Allowance
Messing Subsistance
Commissary
Prisoner Apprehension
Personnel Procurement
Quarters Allowance
Disability
Retirement
School Training
Hazard Pay
Travel/Transportation

ENLISTED BILLET COST ELEMENTS:

Base Pay
Overseas Station Allowance
Command and Administration
Commissary
Death Gratuity
Dependent School
Disability
E-7 Clothing Allowance
Family Separation Allowance
FICA
Sea and Foreign Duty Pay
Insurance/Housing (FHA)
Medical Costs
Messing Subsistence
Prisoner Apprehension
Clothing Allowance
Procurement Personnel
Pro-Pay
Quarters Allowance
Recreation Facilities
Recruiting Costs
Reenlistment Bonus
Retirement
School Costs
Hazard Pay
Severance
Travel

[Ref. 6: p. 3]
[Ref. 7: p. 3]

Figure 4.1 Elements of the Navy Billet Cost Model

to the Navy billet costs to derive the total annual personnel costs to man the AO-177 class fleet oiler to PSMD level. Appendix A shows the detailed derivation of the Navy billet costs for the AO-177 class fleet oiler. The total annual personnel costs associated with Navy military manning are shown in Table III.

TABLE III

Navy Military Manning Personnel Cost Summary

Cost Category	Annual Cost
Navy Billet Cost	3,685,572
Logistic Support	1,106,000
Base Operations Support	106,000
TOTAL NAVY PERSONNEL COST	4,897,572

2. Navy Civil Service Manning

The funding categories included in the civil service personnel cost estimates are shown in Figure 4.2. The base pay cost was computed using the Atlantic Coast wage rates for MSC mariners effective 16 June 1981. These wage rates reflect the maritime union wages paid to MSC civil service mariners serving aboard MSC ships. To derive the MSC base pay cost, the manning levels were applied to the corresponding wage scale to find the total cost of each billet. These billet costs were then summed to find the base pay total. Except where otherwise noted, the other cost categories are based on a percentage of base pay. The Navy civil service manning level and associated base pay is shown in Table IV.

Overtime, Premium/Penalty Pay, Travel, and Other cost categories are dependent on the operating profile of the ship. As no operational data for the AO-177 class fleet oiler exists for these civil service cost categories, the

Base Pay	Travel
Overtime Pay	Damage Control Instruction
Premium/Penalty Pay	Annual Sick and Military Leave
Subsistence	Insurance (Medical and Life)
Retirement	Shore Leave
Other (Relief Officers, awaiting assignment)	Workman's Compensation
	Training

[Ref. 8, Vol. III: p. A-101]

Figure 4.2 Civil Service Personnel Cost Structure

original FY 77 dollar MSC category costs to base pay ratio has been used to compute these categories as a percentage of base pay. The FY 77 dollar costs used were those found in the CIVMAN and CIV 77 studies which for cost comparison purposes used the same operating profile for both Navy and MSC-operated AO-177 class fleet oilers. This percentage was then applied to the FY 81 dollar base pay figure to derive FY 81 dollar cost estimates. All other cost categories were derived based on either OMB Circular A-76 rates or rates provided by the Military Sealift Command Comptroller's Office.

The military detachment billet cost was derived in the same manner as the Navy billet cost was for the Navy military manning option except that only those billets included in the military detachment were used. Appendix A shows this derivation in detail. The indirect cost of logistics support for the military detachment was derived by applying the ratio of military detachment to PSMD manning

TABLE IV

Navy Civil Service Manning Base Pay (Plus Mildet)

Billet	Manning Level	Base Pay	Total
Master	1	78,602	78,602
1st Officer	1	43,910	43,910
2nd Officer	1	30,335	30,335
3rd Officer	2	26,364	52,728
Bosun	2	19,980	39,960
Carpenter	1	18,443	18,443
Bosun Mate	5	16,994	84,970
Able Seaman (M)	6	14,425	86,550
Able Seaman (MT)	14	16,396	229,544
Ordinary Seaman	3	11,432	34,296
Chief Officer	1	50,626	50,626
**********			
Chief Engineer	1	69,528	69,528
1st Asst Engineer	1	43,910	43,910
2nd Asst Engineer	2	38,829	77,658
3rd Asst Engineer	1	33,748	33,748
Unlicensed Jr. Engineer	3	18,024	54,072
Pumpman	3	20,166	60,498
Refrigeration Engineer	1	20,608	20,608
Deck Engineer-Machinist	2	18,473	36,946
Electrician	1	22,053	22,053
2nd Electrician	1	20,608	20,608
Wiper	3	13,242	39,726
3rd Asst Engineer	3	26,364	79,092
**********			
Chief Steward	1	20,060	20,060
Chief Cook	1	17,330	17,330
Asst Cook	1	15,005	15,005
3rd Pantryman	2	11,946	23,892
Cook Baker	1	15,005	15,005
Messman	5	11,052	55,260
Utilityman	9	11,052	99,468
Laundryman	2	11,654	23,308
**********			
Purser Spec.	1	31,047	31,047
Jr. Purser	1	24,400	24,400
Yeoman Storekeeper	4	16,297	65,188
Supply Officer	1	27,298	27,298
Nurse	1	21,112	21,112
TOTAL CIVIL SERVICE BASE PAY			1,746,784

[Ref. 3: p. A-21]
[Ref. 9]

levels to the logistics support figure used in the Navy military manning option. Base operations support costs are assumed to remain constant for both manning options as these costs will be incurred regardless of the manning option chosen. This is because base operations support costs vary according to the number and types of ships which operate out of U.S. naval bases. As the manning option chosen does not affect this criterion a constant BOS cost for each manning option is justified. Table V represents the total Navy civil service personnel costs.

B. TOTAL ANNUAL COSTS

The total annual cost of each manning option includes the personnel costs already derived in this analysis as well as other costs incurred such as operation, maintenance, and berthing and support of the ship. Whereas in the Navy military manning option, the Navy billet, logistics support, and base operations support costs are categorized as personnel costs, the same is not true in the case of the civil service option. Not only are the more obvious costs of fuel, utilities, repair parts, stores and supplies, and other costs categorized as operations costs, but so are the not-so-obvious costs of civil service personnel, and military detachment logistics and base operations support costs. The reason for this is because MSC is reimbursed for its services by the Navy through the Navy Industrial Fund. Maintenance costs are

TABLE V

Navy Civil Service Personnel Costs

Cost Category	Cost
Total Base Pay	1,746,784
Overtime (.59 Base Pay) (1)	1,030,603
Premium/Penalty Pay (.06 Base Pay) (1)	104,807
Subsistence ($5.50 per man per day) (2)	178,668
Other (.0597 Base Pay) (1)	104,283
Retirement (.204 Base Pay) (3)	356,344
Life & Health Insurance (.037 Base Pay) (2)	64,631
Workman's Compensation (.019 Base Pay) (2)	33,189
Shore Leave (.105 Base Pay) (2)	183,412
Annual Sick & Military Leave (.245 Base Pay) (2)	427,962
Travel (.002 Base Pay) (2)	3,494
TOTAL CIVIL SERVICE PERSONNEL COST	4,234,177
Mildet Billet Cost	493,930
Mildet Logsitic Support	145,232
Mildet BOS	106,000
TOTAL PERSONNEL COST	4,979,339

(1) No data exists; original MSC estimate used as a percentage of Base Pay.

(2) Furnished by MSC comptroller's office.

(3) Based on OMB Circular A-76.

[Ref. 9]

comprised of restricted availability (RAV), intermediate maintenance activity (IMA), and overhaul in the case of the Navy military manning option. All civil service maintenance costs, including overhaul, are included in the "civil service maintenance" cost category. The total cost breakdown shown

in Figure 4.3 will be used to illustrate total annual costs. The following paragraphs describe the methodology used to estimate the total annual costs of each manning option.

PERSONNEL
- Navy Billet Cost/Mildet Billet Cost
- Logistics Support
- Base Operations Support (BOS)

OPERATIONS
- Civil Service Personnel
- Fuel
- Utilities
- Repair Parts
- Stores and Supplies
- Other
- Mildet Logistics Support*
- Mildet BOS*

MAINTENANCE
- Restricted Availability (RAV)
- Intermediate Maintenance Activity (IMA)
- Overhaul
- Civil Service Maintenance (Includes Overhaul)

MSC OVERHEAD

* These costs reflect the personnel costs of the Mildet assigned to MSC ships. These costs, plus the civil service personnel costs (in the case of the civil service option), are categorized as operations costs because MSC is reimbursed by the Navy through the Navy Industrial Fund. MSC bills the Navy for its services.

[Ref. 8, Vol. II: p. IV-19]

Figure 4.3 Total Annual Cost Structure

1. Navy Military Manning

The annual personnel costs associated with the Navy military manning option have been computed previously in this analysis. All of the indirect personnel costs and

operations and maintenance costs for the AO-177 class fleet oiler were obtained from the October 1979 Navy Program Factors Manual for FY 81 dollars. It should be noted that the Navy Program Factors Manual assumes a four year overhaul cycle with RAV's and IMA work scheduled at regular, frequent intervals between overhauls. Table VI gives the total annual cost breakdown for the Navy military manning option.

TABLE VI

Navy Military Manning Alternative Total Annual Costs

Cost Category	Cost
PERSONNEL	
Navy Billet Cost	3,685,572
Logistics Support	1,106,000
Base Operations Support	106,000
OPERATIONS	
Fuel	1,578,000
Utilities	368,000
Repair Parts	311,000
Other	402,000
MAINTENANCE	
RAV	367,000
IMA	323,000
Annual Overhaul	3,934,000
TOTAL NAVY MILITARY MANNING ANNUAL COSTS	12,268,572

Note: Unit overhaul costs are 18,030,000 at four year intervals, and of seven month duration.

[Ref. 10]

2. Navy Civil Service Manning

The total annual personnel costs to man a ship with Navy civil service mariners and the associated military detachment have been computed previously in this analysis. The personnel costs resulting from the civil service crew, as well as the indirect cost associated with the military detachment, are categorized as operations costs because MSC is reimbursed for its services by the Navy through the Navy Industrial Fund. The indirect operations cost of logistics support has been reduced proportionally by the ratio of the military detachment to the total PSMD manning level. As stated previously, base operations support costs are assumed to remain constant for both manning options as these costs will be incurred on naval bases regardless of the manning option chosen for the AO-177 class fleet oiler.

The operations costs of fuel and utilities have been assumed to be equal to those of the Navy military manning option. This was because no current data exists at Military Sealift Command concerning these estimates. The FY 77 dollar estimate made by MSC for the CIVMAN study included aggregated figures for "MSC OPERATIONS (Annual)" and "MSC MAINTENANCE (Annual)." The operations figure included costs of fuel, and stores and supplies but did not enumerate these costs. As stated previously, it was therefore necessary to assume that the fuel cost of the civil service manning option

equals that of the Navy military manning option. Therefore, by subtracting the Navy fuel cost derived for the CIVMAN study from the "MSC OPERATIONS" figure, one derives the cost of stores and supplies for the civil service manning option.

"MSC MAINTENANCE" costs vary from year to year primarily due to the MSC policy of overhauling ships biennially. MSC also performs 30-45 day mid-period inspections between overhaul years at which time other repair work is performed. These actions result in a six year period of varying maintenance costs. Therefore, in order to compensate for yearly differences in maintenance costs, these costs were annualized for annual cost purposes by dividing the total projected maintenance costs for the AO-177 class fleet oiler by the length of the overhaul cycle, six years.

The "MSC OPERATIONS" and "MSC MAINTENANCE" costs were converted to FY 81 dollars by use of the DoD Operations and Maintenance economic index conversion factor of 1.43 for FY 77 to FY 81. This factor was provided by the Department of Defense Comptroller's Office. The total annual budget cost breakdown for the Navy civil service manning option is shown in Table VII.

3. Total Annual Cost Comparison

The total annual costs for each manning option were derived primarily from the Navy Program Factors Manual, the Navy Billet Cost Model, and CIVMAN. These annual costs were

TABLE VII

Navy Civil Service Manning Total Annual Costs

Cost Category	Cost
OPERATIONS	
Civil Service Personnel	4,234,177
Fuel	1,578,000
Utilities	368,000
Stores and Supplies	281,710
Mildet Logistics Support	145,232
Mildet BOS	106,000
MAINTENANCE	
Ship's Maintenance (Includes Overhaul)	1,454,310
OPERATIONS/MAINTENANCE SUBTOTAL	8,167,429
MSC OVERHEAD (.05 Surcharge)	408,371
PERSONNEL	
Mildet Billet	493,930
TOTAL NAVY CIVIL SERVICE MANNING ANNUAL COSTS	9,069,730

Note: The reconfiguration costs to convert the AO-177 class fleet oiler to civilian manning was estimated at $22 million in FY 81.

separated into the three cost categories of personnel, operations, and maintenance. Whereas the summed annual personnel and operations costs of both manning options are nearly equal, the annual Navy maintenance costs are much greater than those of MSC. There are two plausible reasons for this disparity; either the MSC maintenance costs, which were derived from CIVMAN, are underestimated, or the Navy maintenance policy is considerably different than that of MSC. A comparison of the two maintenance policies reveals

some significant differences. The Navy schedules restricted availabilities and intermediate maintenance on a regular, frequent basis between major overhauls. MSC schedules overhauls every two years with mid-year inspection/repair in between. While it is not the intent of this study to delve any deeper into the overhaul policies of either organization, this is an area of considerable interest and should be the subject of further research. A possible reason for a more costly Navy maintenance policy could be that the Navy expects to operate a ship well beyond thirty years, as evidenced by the number of operational Navy and Navy-conversion to MSC oilers presently over thirty years of age.

For the purposes of this study a thirty year life has been assumed for the AO-177 class fleet oiler. Given this limiting assumption, it might also be assumed that a different overhaul policy could be adopted that would still be adequate to maintain the AO-177 for thirty years. Assuming that MSC's maintenance policy meets this criterion, then it is reasonable to question what the Navy military and Navy military-conversion to civil service life cycle costs would be if the Navy were to adopt the MSC maintenance policy for the AO-177 class fleet oiler. The sensitivity of life cycle costs to this change in maintenance policy will be examined for both alternatives in the next chapter.

C. TOTAL LIFE CYCLE COSTS (DISCOUNTED)

To derive comparative life cycle costs for each manning option, the cost elements considered in the total annual cost breakdown have been discounted over a thirty year period using ten percent mid-year discount factors. The total cost structure used in Figure 4.3 will be used to illustrate the life cycle costs.

1. Navy Military Manning Life Cycle Costs

For the purposes of this analysis a thirty year life has been assumed for the AO-177 class fleet oiler. As previously stated, the annual costs of personnel in the Navy military manning option were estimated using the Navy Billet Cost Model for FY 81. The indirect cost categories of logistics support and base operations support are not included in the model and have therefore been included in the life cycle cost analysis. These annual costs were then discounted over a thirty year period to derive the life cycle personnel costs.

To determine the life cycle cost of operations and maintenance, the annual cost categories derived earlier in this study have been discounted over a thirty year period. Reconfiguration costs for the Navy military manning option are considered to be zero. The Navy military manning option life cycle cost breakdown is shown in Table VIII.

TABLE VIII

Navy Military Manning Life Cycle Costs

Cost Category	Annual Cost	30 Year Discounted Life Cycle Cost
PERSONNEL		
Navy Billet Cost	3,685,572	38,219,382
Logistics Support	1,106,000	11,469,220
BOS	106,000	1,099,220
OPERATIONS		
Fuel	1,578,000	16,363,860
Utilities	368,000	3,816,160
Repair Parts	311,000	3,225,070
Other	402,000	4,168,740
MAINTENANCE		
RAV	367,000	3,805,790
IMA	323,000	3,349,510
Annual Overhaul	3,934,000	40,795,580
RECONFIGURATION	0	0
TOTAL NAVY MILITARY MANNING LIFE CYCLE COST		126,312,532

[Refs. 6, 7, 10]

2. Navy Civil Service Manning Life Cycle Costs

In deriving the thirty year life cycle costs associated with the civil service manning option for the AO-177 class fleet oiler some initial assumptions must be made. Navy representatives estimated that in FY 81 it would cost a minimum of twenty-two million dollars to convert the AO-177 to civilian manning [Ref. 1]. It will be assumed that the first overhaul on the AO-177 fleet oiler will be in FY 85 after four years operation as a Navy manned vessel, and that

conversion to civilian manning will take place at that time. It will also be assumed that the reconfiguration will take twelve months. Given these assumptions, the Navy military operations, maintenance (including overhaul), and personnel annual costs will be discounted over four years, to account for the economic costs of operating the ship as a military vessel for four years. For the next year, during which the overhaul and reconfiguration take place, only the cost of reconfiguration will be included in the life cycle costing analysis. This is because it will be assumed that the Mildet and civil service crew will be assigned after completion of the overhaul/reconfiguration, and that all remaining operations and maintenance costs for the overhaul/reconfiguration period will be zero. It must be remembered that the cost of overhaul has already been included by discounting the Navy annual overhaul costs over four years. The discounted reconfiguration figure will be derived by taking the net present value of the FY 81 reconfiguration estimate in FY 85. For the remaining twenty-five years of civil service operation, the annual cost categories of operations and maintenance which were derived for the civil service option annual costs were discounted at ten percent over twenty-five years. The annual military detachment costs were computed by applying the billet cost by rate and paygrade to the number of Navy personnel in the military

detachment. These costs were then discounted using the same method described for the civil service operation and maintenance costs. The civil service operation and maintenance, and Navy military detachment costs were then added to the discounted costs of operating the ship with a Navy crew for four years. The Navy military-conversion to civil service manning life cycle costs are shown in Table IX.

D. CUMULATIVE COST ANALYSIS

To determine comparative life cycle costs for each manning option, the total annual costs were discounted over thirty years using mid-year discount factors corresponding to a ten percent discount rate. Cumulative costs of each manning option will now be derived so that they, too, can be compared. These cumulative, undiscounted costs for each manning option will be shown graphically on a time versus cumulative cost graph as illustrated in Figure 4.4.

In deriving the cumulative cost line for the Navy military manning option, the total annual costs were simply multiplied by the thirty year life of the AO-177 class fleet oiler. The cumulative cost line resulting is shown connecting the origin and the total cumulative cost of the Navy military manning option over a thirty year period.

To derive the cumulative cost line for the civil service manning option, the same method was applied except the cost of reconfiguration also had to be represented. For the

TABLE IX

Navy Military - Conversion to Civil Service Life Cycle Costs

NAVY MILITARY COSTS (4 YEARS)

Cost Category	Annual Cost	4 Year Discounted Cost
PERSONNEL		
Navy Billet Cost	3,685,572	12,851,590
Logistics Support	1,106,000	3,856,458
BOS	106,000	369,606
OPERATIONS		
Fuel	1,578,000	5,502,252
Utilities	368,000	1,283,162
Repair Parts	311,000	1,084,411
Other	402,000	1,401,715
MAINTENANCE		
RAV	367,000	1,279,675
IMA	323,000	1,126,253
Annual Overhaul	3,934,000	13,717,276
TOTAL 4 YEAR NAVY DISCOUNTED COST		42,472,398

CIVIL SERVICE COSTS (25 YEARS)

Cost Category	Annual Cost	25 Year Discounted Cost
PERSONNEL		
Mildet Billet Cost	493,930	3,215,593
OPERATIONS		
Civil Service Personnel	4,234,177	27,565,424
Fuel	1,578,000	10,273,127
Utilities	368,000	2,395,761
Stores & Supplies	281,000	1,829,372
Mildet Logistics Support	139,646	909,126
Mildet BOS	106,000	690,083
MAINTENANCE		
Maintenance (includes overhaul)	1,454,310	9,467,878

TABLE IX (Continued)

MSC OVERHEAD (.05 Surcharge)	408,648	2,660,388
RECONFIGURATION		15,744,000
TOTAL DISCOUNTED CIVIL SERVICE LIFE CYCLE COSTS		74,750,753
TOTAL DISCOUNTED NAVY COSTS		42,472,398
TOTAL NAVY - CIVIL SERVICE LIFE CYCLE COSTS		117,223,151

Note: The reconfiguration figure represents the net present value of the FY 81 reconfiguration estimate of $22 million in FY 85.

[Refs. 6, 7, 10]

initial four years of this option the line would be the same as that for the Navy military manning option. The reconfiguration and associated zero operating and maintenance costs are shown by the spike and horizontal section of the line. Then, to derive the cumulative cost of the civil service option, the total annual costs of the civil service option were multiplied by twenty-five and added to the cumulative costs of the initial five years (four years Navy operation and one year reconfiguration) of the oiler's life.

It can be seen that the slope of each line is the total annual cost associated with the manning option it represents. As the total annual costs for the civil service manning are less than those of the Navy military option, the cumulative

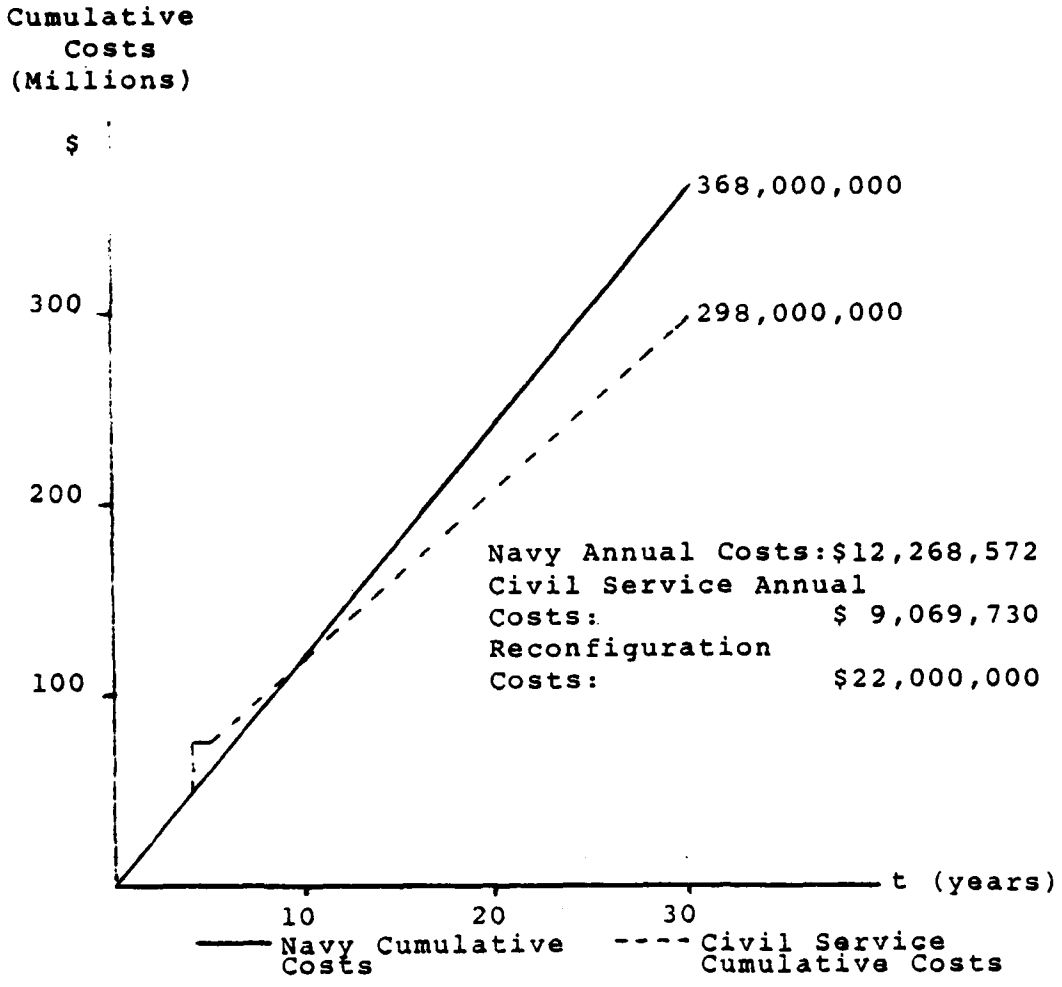

Figure 4.4 Cumulative Cost Graph

cost lines cross. This is significant in that it implies that with a sufficiently large discount rate, the life cycle costs of the Navy military manning option would be less than those of the civil service manning option due to the relative weight that discounting places on early year costs in life cycle costing. It has already been determined that the civil service manning option has the smaller life cycle costs at a ten percent discount rate. The sensitivity of life cycle costs to differing discount rates will be examined in the next chapter to determine at what discount rate the relative life cycle costs of the manning options reverse.

E. BASELINE COST ANALYSIS SUMMARY

In this chapter thirty year life cycle costs have been developed for both the Navy military and Navy-conversion to civil service manning options for the AO-177 class fleet oiler. FY 81 dollars were used as the base to determine annual personnel and total annual costs for each manning option. In that total annual costs drive life cycle costs to a considerable degree, the manning option total annual costs were then analyzed to determine what manning option cost elements were significantly different. The maintenance cost element in the civil service option was found to be considerably less than that for the Navy military option. The possible reasons for this were discussed and then the

question was posed of what effect an MSC maintenance policy would have on Navy life cycle costs.

Life cycle costs for each manning option were derived by discounting the total annual costs using mid-year discount factors corresponding to a ten percent discount rate. An analysis of cumulative costs of each manning option followed. These cumulative costs were portrayed graphically to indicate that with a sufficiently large discount rate the relative life cycle costs derived for each manning option could reverse.

The costs developed in this chapter represent a baseline cost analysis of both the Navy military and Navy-conversion to civil service manning options for the AO-177 class fleet oiler. To derive these baseline costs, however, several assumptions were made which affected the eventual life cycle cost outcomes for each manning option. The weaknesses inherent in the baseline costing data sources must also be recognized in that they cause the life cycle costs of each manning option to be understated. The life cycle costs derived in this chapter must therefore be analyzed for sensitivity to varying cost elements, and discount rates. This sensitivity analysis, as well as presentation of other non-quantifiable factors which, due to the degree of softness of the life cycle costs would affect a manning option decision to a very significant degree, will be done in Chapter V.

V. LIFE CYCLE COST SENSITIVITY AND NON-QUANTIFIABLE FACTORS

Total life cycle costs for both the Navy military and civil service manning options for the AO-177 class fleet oiler were developed in Chapter IV. As was illustrated in Table IX, the civil service life cycle costs included four years as a Navy military manned ship, one year as an inactive ship undergoing overhaul/reconfiguration, and twenty-five years as a civil service manned ship. A comparison of the life cycle costs developed for each manning option shows the civil service manning option to be the least expensive. All costs derived for this analysis do have a degree of softness, however, due to some of the necessary assumptions used in their derivation and the inherent weaknesses of the baseline costing data sources used in this study. In this chapter those "soft" cost elements will be identified and then the effects of changes in these elements upon life cycle costs will be examined. In addition, life cycle costs will be examined for sensitivity to changing discount rates.

Sensitivity analysis in the traditional sense is conducted on baseline costs which are considered to be most representative of actual costs. In this study, however, the baseline cost analysis was based on data sources with recognized weaknesses, and therefore may not be fully representative

of present conditions as they apply to the AO-177 class fleet oiler. Some of the sensitivity analysis in this study will therefore attempt to reflect changes which have occurred since the baseline cost data was published. The sensitivity of the baseline life cycle costs to these particular changes will be done both individually and simultaneously.

Not only must the life cycle costs be scrutinized for sensitivity to change in the various cost elements and discount rates, but also other, non-quantifiable factors must be examined which would weigh heavily in any manning decision. These factors are Navy fleet oiler force level requirements to support carrier battle groups, the expected recruiting environment during this decade, and the requirement for a Navy operated AO-177 class fleet oiler to serve as a training platform for the multi-product AOE/AOR ships.

A. EFFECT OF CHANGING COST ELEMENTS ON LIFE CYCLE COSTS

1. Navy Billet Cost

The civil service personnel cost element of the civil service manning option is significantly greater than the Navy billet cost element of the Navy military manning option. This reflects the higher base wage being paid to the civil service mariners. Both the MSC civil service wage scale and the Navy Billet Cost Model reflect FY 81 costing data. The MSC civil service wage scale reflects the latest pay increase received by MSC civil service mariners, and for the purposes of life

cycle costing it was assumed that no further pay increases would be received by them. The FY 81 Navy Billet Cost Model, however, does not reflect a large pay increase received by military personnel in FY 82. In an effort to guage the effect of the military pay increase on the Navy billet cost and subsequently total annual and life cycle costs, the Composite Standard Military Rates for both FY 81 and FY 82 were examined. These rates were found in NAVCOMPTNOTE 7041 dated 18 November 1980, and 2 December 1981 respectively [Refs. 11, 12]. A comparison of these rates shows an average increase by a factor of 1.165 from FY 81 to FY 82.

Although it is not known exactly what elements of the Navy billet cost are affected by the pay increase, it is estimated that 81.5 percent of the billet cost would be. This percentage estimate was derived by initially computing the total composite standard rate for the AO-177 class fleet oiler by applying the manning levels of each pay grade in the PSMD to the FY 81 composite rate for that pay grade. This total composite rate figure when divided by the FY 81 total Navy billet cost yielded a result of .815. For the purposes of this study, this figure (.815) was applied to the Navy billet cost to derive the amount which would increase due to a pay increase. This affected amount was then increased by a factor of 1.165 and then added to the remaining unaffected portion of the Navy billet cost to derive an annual Navy billet cost to include the pay increase.

This annual Navy billet cost was then discounted over thirty years to derive the Navy military life cycle costs. The same method was then applied to derive the increased Mildet billet cost in the case of the civil service manning option. The following formulas illustrate this methodology:

$$\frac{\text{CSMR FY 82}}{\text{CSMR FY 81}} = 1.165,$$

$$\frac{\text{CSMR FY 81}}{\text{NBC FY 81}} = .815.$$

Increased NBC = .815 (NBC FY 81)(1.165) + .185 (NBC FY 81),

Where: CSMR = Composite Standard Military Rate, and
NBC = Navy Billet Cost.

To derive the increased life cycle cost of the civil service option, the effect of the pay increase had to be applied to the Navy military billet costs for four years, and then the Mildet billet costs for twenty-five years. Discounting, as before, was done using ten percent mid-year factors to derive life cycle costs. The effect of the FY 82 military pay increase on annual personnel, total annual, and life cycle costs is shown in Table X. It can be seen that the FY 82 military pay increase significantly increases the difference between the life cycle costs of the two manning options.

TABLE X

Effect of FY 82 Military Pay Increase

Cost Category	Baseline	Increased
Annual Navy Billet Costs	3,685,572	4,181,189
Total Navy Annual Costs	12,268,572	12,764,189
TOTAL NAVY LIFE CYCLE COSTS	126,312,532	131,452,081
Annual Mildet Billet Costs	493,930	559,739
Total Civil Service Annual Costs	9,069,730	9,135,539
Navy Billet Costs (discounted over four years)	12,851,590	14,579,808
Navy Mildet Costs (discounted over twenty-five years)	3,215,593	3,644,024
TOTAL NAVY-CONVERSION TO CIVIL SERVICE LIFE CYCLE COSTS	117,223,151	119,379,800

2. Increased Operations Tempo

A significant difference between the Navy billet and civil service personnel cost structures is that MSC civil service mariners are paid overtime pay. This overtime pay cost element is directly related to the operations tempo of the ship on which they serve. With an increase in operations tempo the operations cost elements of fuel, repair parts, stores and supplies and the maintenance cost elements of RAV, IMA, and overhaul would all increase in the case of both manning options. These costs would, however, remain relatively the same as they were for the cost analysis

conducted in Chapter IV. Therefore no difference in the life cycle cost relationship of the two manning options would result from those changes. The same cannot be said of the overtime pay cost element. It is conceivable that an increase in operations tempo could ultimately result in an overtime pay to base pay ratio of one or greater, instead of the .59 overtime to base pay ratio used in the baseline cost analysis. As was stated previously in this study, the .59 figure was derived from the CIVMAN and CIV 77 studies which assumed equal operating profiles for both Navy and MSC-operated AO-177 class fleet oilers. For the purposes of this study an increase in operations tempo resulting in an overtime to base pay ratio of one will be examined. This will be accomplished by substituting an overtime figure equal to the base pay figure shown in Table V to derive an increased Navy civil service personnel cost figure. This increased civil service personnel cost will then be used to derive increased total annual and discounted life cycle costs for the civil service manning option. Table XI shows the effect of an increased operations tempo on civil service personnel, total annual, and life cycle costs. It can be seen that an increased operations tempo significantly increases the civil service option life cycle costs.

3. Overhaul Cycle Lengthened to Eight Years

As stated previously, the 1979 Navy Program Factors Manual states that the time between overhauls for the AO-177

TABLE XI

Effect of an Increased Operations Tempo

Cost Category	Baseline	Increased
Civil Service Personnel	4,234,177	4,950,358
Total Annual Cost	9,069,730	9,821,721
TOTAL NAVY-CONVERSION TO CIVIL SERVICE LIFE CYCLE	117,223,151	121,885,647

class fleet oiler is four years and that the duration of each overhaul is seven months. Informal conversations with OPNAV 375 personnel, however, indicate that this time between overhauls may have been increased to eight years. A change of this magnitude in overhaul cycle would have a significant effect on life cycle cost analysis for both the Navy military and Navy conversion to civil service manning operations. To determine the effect such a change would have on the Navy military manning option, some assumptions will be made. It will be initially assumed that the lengthened time between overhauls will require the overhaul duration to also lengthen to one year. For this analysis it will be hypothesized that the annual RAV and IMA maintenance cost elements would double to account for the required increased annual RAV and IMA support necessary in a lengthened overhaul cycle. To derive the annual overhaul cost associated with an eight year overhaul cycle, the unit overhaul cost

figure must first be adjusted. Therefore the unit overhaul cost will be doubled but then the amount of additional RAV and IMA maintenance costs incurred as a result of the lengthened overhaul cycle will be deducted from that doubled unit overhaul cost figure to derive the adjusted unit overhaul cost figure for an eight year overhaul cycle. The additional RAV and IMA costs will be deducted from the unit overhaul costs because it is reasonable to assume that the additional annual costs incurred during the overhaul cycle would ultimately reduce the unit overhaul cost at the end of the cycle. Then to derive the annual overhaul cost, the unit overhaul cost is divided by the sum of the length of time between overhauls and the duration of the overhaul. Therefore, to derive the adjusted annual overhaul cost, in this case, the adjusted unit overhaul cost must be divided by nine. To determine the effect of these changes on the Navy military life cycle costs, the adjusted annual RAV, IMA, and overhaul costs will be discounted over thirty years.

An increased overhaul cycle would also affect the life cycle costs of the Navy military-conversion to civil service manning option. Conversion would take place after eight years of Navy military operation instead of after four years, so all annual Navy military costs will be discounted over eight years. The Navy military annual RAV, IMA, and overhaul costs must, as they were in the Navy military manning option, be adjusted to account for the increased RAV

and IMA support associated with a lengthened overhaul cycle. As in the baseline analysis, an overhaul/reconfiguration time of twelve months will be assumed. During that year only the reconfiguration costs will be included in the life cycle costing as the overhaul cost has already been included by discounting the Navy annual overhaul cost over eight years. The reconfiguration cost will represent the net present value of the FY 81 reconfiguration estimate of twenty two million dollars in FY 89. It will also again be assumed that the Mildet and civil service crew will be assigned to the ship after completion of the overhaul/reconfiguration and that all operations and maintenance costs for the overhaul/reconfiguration period will be zero. For the remaining twenty-one years of civil service operation, the civil service annual operations and maintenance costs and Mildet personnel costs will be discounted in the same manner as was done in Chapter IV.

The effect of an eight year overhaul cycle on the Navy military manning option is shown in Table XII. Only those cost elements affected are included. Table XII also shows the effect of an eight year overhaul cycle on the Navy military-conversion to civil service manning option. All cost elements had to be included in this portion of the table as it was assumed that the conversion would coincide with the first overhaul after eight years operation as a Navy manned oiler.

TABLE XII

Overhaul Cycle Lengthened to Eight Years

Effect of an 8 Year Overhaul Cycle on Navy Military Manning Life Cycle Costs

Cost Category	Baseline	Adjusted	Adjusted 30 Year Discounted Life Cycle Cost
RAV Annual Cost	367,000	734,000	7,611,580
IMA Annual Cost	323,000	646,000	6,699,020
Unit Overhaul	18,030,000	30,540,000	N/A
Annual Overhaul	3,934,000	3,393,333	35,188,863
TOTAL NAVY MILITARY MANNING LIFE CYCLE COST WITH AN 8 YEAR OVERHAUL CYCLE			127,861,115

Effect of an 8 Year Overhaul Cycle on Navy Military Converted to Civil Service Life Cycle Costs

Navy Military Costs (8 Years)

Cost Category	Adjusted Annual Cost	8 Year Discounted Cost
PERSONNEL		
Navy Billet Cost	3,685,572	21,626,936
Logistics Support	1,106,000	6,490,008
BOS	106,000	622,008
OPERATIONS		
Fuel	1,578,000	9,259,704
Utilities	368,000	2,159,424
Repair Parts	311,000	1,824,948
Other	402,000	2,358,936
MAINTENANCE		
RAV	734,000	4,307,112
IMA	646,000	3,790,728
Annual Overhaul	3,393,333	19,912,078
TOTAL 8 YEAR NAVY DISCOUNTED COST		72,351,883

TABLE XII (Continued)

Civil Service Costs (21 Years)

Cost Category	Adjusted Annual Cost	21 Year Discounted Cost
PERSONNEL		
Mildet Billet Cost	493,930	2,091,166
OPERATIONS		
Civil Service Personnel	4,234,177	17,926,362
Fuel	1,578,000	6,680,826
Utilities	368,000	1,558,013
Stores & Supplies	281,000	1,189,678
Mildet Logistics Support	139,646	591,223
Mildet BOS	106,000	448,775
MAINTENANCE		
Maintenance (includes overhaul)	1,454,310	6,157,156
MSC OVERHEAD (.05 Surcharge)	408,648	1,730,105
RECONFIGURATION		10,758,000
TOTAL DISCOUNTED CIVIL SERVICE LIFE CYCLE COSTS		49,131,305
TOTAL DISCOUNTED NAVY COSTS		72,351,883
TOTAL NAVY-CIVIL SERVICE LIFE CYCLE COSTS		121,483,188

Note: The reconfiguration figure represents the Net Present Value of the FY 81 reconfiguration estimate of $22 million in FY 89.

It can be seen that the lengthened overhaul cycle has increased the life cycle costs of both manning options. The effect is more significant in the civil service manning option, however, indicating that the relative position of this manning option is degraded by an eight year overhaul cycle when compared with the Navy military manning option.

4. Simultaneous Cost Element Changes

The individual effects of the FY 82 military pay increase, increased operations tempo, and lengthened overhaul cycle on life cycle costs have been determined in this chapter. In view of the FY 82 military pay increase, increased fleet operating tempos due to Indian Ocean commitments, and altered Navy ship overhaul cycles, however, it is conceivable that all three changing cost elements could affect life cycle costs simultaneously. The cumulative effect that a simultaneous military pay increase, increased operations tempo, and lengthened overhaul cycle would have on life cycle costs of each manning option will now be determined.

The effect that simultaneous cost element changes would have on the Navy military option only deals with the FY 82 military pay increase and lengthened overhaul cycle. As discussed earlier in this study, an increased operations tempo does not increase the Navy military manning option costs relative to the civil service manning option costs. To derive the life cycle costs associated with increased pay and a lengthened overhaul cycle for the Navy military manning option, the annual cost elements of Navy billet cost, RAV, IMA, and overhaul were increased to reflect the cost element changes. All of the annual cost elements were then discounted at a ten percent discount rate over thirty

years to derive the adjusted life cycle costs for the Navy military manning option.

To derive the life cycle costs for the Navy-conversion to civil service manning option associated with simultaneous cost element changes, the Navy military cost elements for the initial eight years had to be adjusted to reflect the military pay increase and lengthened overhaul cycle. This was done in the same manner as described in the previous paragraph. For the remaining twenty-one years of civil service operation the cost element of Mildet billet cost had to be adjusted to reflect the military pay increase. An increase in operations tempo would result in an increased civil service personnel cost element and, consequently, in an increased MSC overhead cost element. All adjusted Navy military and civil service cost elements were then discounted over eight and twenty-one years respectively to derive the adjusted Navy-conversion to civil service life cycle costs. The Navy military and Navy-conversion to civil service adjusted life cycle costs associated with a simultaneous increase in military pay, increased operations tempo, and lengthened overhaul cycle are shown in Table XIII. It can be seen that simultaneous cost element changes affect the Navy military-conversion to civil service manning option to a greater degree than they do the Navy military manning option.

TABLE XIII

Effect of Simultaneous Cost Element Changes
on Life Cycle Costs

Cost Category	Baseline	Adjusted
Navy Military Life Cycle Cost	126,312,352	133,000,663
Navy Military-Conversion to Civil Service Life Cycle Cost	117,223,151	127,855,309

5. Life Cycle Cost Sensitivity to MSC Maintenance Policy

When comparing the total annual cost elements of each manning option, the maintenance cost element in the civil service manning total annual cost was found to be significantly less than that of the Navy military manning option. As was discussed in Chapter IV, this difference might be because the Navy maintenance policy is structured to maintain a ship beyond a thirty year life. If this is true, then by limiting a Navy military manned ship to no more than a thirty year life could result in a different maintenance policy. Assuming that MSC's maintenance policy meets this criterion, then it is reasonable to question what the Navy military and Navy military-conversion to civil service life cycle costs would be if the MSC maintenance policy were substituted for the Navy maintenance policy. The resulting life cycle costs from this substitution are shown in Table XIV.

TABLE XIV

Life Cycle Cost Sensitivity to MSC Maintenance Policy

Life Cycle Cost Category	Baseline	Adjusted
Navy Military Option	126,312,532	100,598,147
Navy Military-Conversion to Civil Service Option	117,223,151	108,576,839

It is evident from Table XIV that the substitution of the MSC maintenance policy for the Navy maintenance policy results in significantly lower life cycle costs for both manning options. In addition, and more importantly, it shows a Navy military life cycle cost considerably less than the Navy military-conversion to civil service manning life cycle cost. Assuming that the MSC maintenance policy is capable of maintaining a fleet oiler over a thirty year lifetime, and that the Navy would only operate the AO-177 for thirty years, the Navy could realize substantial maintenance life cycle cost savings by adopting a different maintenance policy for the AO-177 class fleet oiler. Note, however, that a considerable amount of long run readiness may be sacrificed by this change in maintenance policy. The examination of whether such a change would be cost-effective is beyond the scope of this effort.

6. Life Cycle Cost Sensitivity to Discount Rate

All life cycle costs in this study have been derived using mid-year discount factors associated with a ten percent discount rate. As was discussed in Chapter IV, however, a discount rate does exist at which the life cycle costs for the Navy military manning option would be less than those for the Navy-conversion to civil service manning option. This was made apparent in the graphical display of cumulative costs shown in Figure 4.4. In an effort to determine the discount rate at which a relative change in option life cycle costs would occur, the annual cost elements derived in Chapter IV were discounted at 20, 15, 12.5, and 12 percent discount rates. The life cycle costs resulting from these various discount rates are shown in Table XV.

It can be seen that the life cycle cost is very sensitive to discount rate variability, and that at a discount rate of approximately twelve percent, the life cycle costs of the Navy military option become less than the Navy military-conversion to civil service manning option. This is very significant in that a discount rate of twelve percent is by no measure unreasonable and is, in fact, very possible.

The life cycle costs adjusted for simultaneous changes in cost elements associated with a military pay increase, increased operations tempo, and lengthened overhaul cycle were also examined for sensitivity to the discount

TABLE XV

Effect of Changing Discount Rates on Life Cycle Costs

Manning Option	Discount Rate	Life Cycle Costs
Navy Military Option	10 percent	126,312,532
	12 percent	109,893,121
	12.5 percent	106,421,658
	15 percent	91,975,499
	20 percent	72,778,918
Navy-Conversion to Civil Service Option	10 percent	117,223,151
	12 percent	109,090,179
	12.5 percent	107,311,683
	15 percent	99,664,625
	20 percent	88,662,482

rate. In this case it was found that the Navy military life cycle costs were essentially equal to the Navy military-conversion to civil service option costs at an eleven percent discount rate, indicating an even greater sensitivity to discount rate than the baseline life cycle costs.

The degree of sensitivity of life cycle costs to the discount rate that has been illustrated is primarily due to the costs of reconfiguration experienced early in the civil service manned AO-177 class fleet oiler's life. In that the initial four (or eight) years of the ship's life are spent as a Navy military manned ship (and consequently the costs of both options are equal during this time), the cost of reconfiguration weighs heavily against the civil service

option. At a twelve percent discount rate, or an eleven percent discount rate in the case of the adjusted cost elements, the early cost of reconfiguration outweighs the smaller total annual costs associated with the civil service manning option during the latter years of the oiler's life. In any manning option decision, it is essential that this phenomenon be recognized.

B. NON-QUANTIFIABLE FACTORS

Earlier in this chapter, life cycle costs were examined for sensitivity to varying cost elements and discount rates. Not only would life cycle cost sensitivity affect any decision which would be made concerning a manning option for the AO-177 class fleet oiler, but also other non-quantifiable factors would be considered. The non-quantifiable factors which will be examined in the remainder of this chapter are Navy fleet oiler force level requirements, the expected recruiting environment during this decade, and the necessity for a Navy operated AO-177 class fleet oiler to serve as a training platform for the multi-product AOE/AOR ships. These are factors which would be difficult to assign a dollar value to, but which, nevertheless, would weigh heavily in any manning option decision.

1. Navy Fleet Oiler Force Level Requirements

The Underway Replenishment Requirements and Forces Study, (UNREP 84), recommended a minimum oiler force of

twenty Navy or civil service manned oilers. UNREP 88, the latest in this series of replenishment studies, forecasts new scenarios and recommends higher levels commensurate with the number of carrier battle groups (CVBG) and battleship surface action groups (BB SAG) to be supported. In 1975, when the first two AO-177 class fleet oilers were authorized, the oiler inventory was nineteen. With the exception of the AO-177's, the oiler force is quite old, and by the end of FY 82 will number only seventeen units [Ref. 1]. From these facts it can easily be seen that the oiler force level is already below recommended inventory levels and is diminishing. It was partly for this reason that the AO-177 class fleet oiler has been built as a Navy military ship, as any delay in conversion prior to delivery would have greatly degraded an already restricted oiler force level. Not only did this consideration affect the manning option decision prior to delivery of the AO-177 class fleet oiler, but it will also affect any future manning option decision that might be made. As stated previously in this study, it is estimated that conversion of a Navy military AO-177 class oiler to civilian manning would take 12-15 months. The removal of these ships from service in the future for conversion would adversely affect the ability of the oiler force to support the battle groups and an expanding Navy.

2. Expected Recruiting Environment during this Decade

The Navy, and consequently its need for personnel, will expand during this decade. During this time of expansion, however, several factors are working against the ability of the Navy to attract the number of quality recruits that it will need. These factors must be examined, as any significant shortage of Navy personnel could require the increased use of MSC civil service mariners on Navy fleet support ships.

The domestic trends that will most significantly affect the ability of the Navy to attract recruits concern the youth population. It is expected that the 17-21 year old male population will decrease by seventeen percent by the end of this decade. Coincident with this decline is a higher birth rate among Blacks and Hispanics than among whites. These factors will affect the Navy in that English language comprehension among many youth could become a major problem for an ever more technical Navy [Ref. 13: p. 4].

With a decline in the youth population, greater competition from both institutions of higher learning and business to attract quality high school diploma graduates can be expected. At the same time, although the military in general is receiving increased appropriations for both hardware and personnel, offsetting savings are being pursued through recruiting budget cuts. In addition, notwithstanding

strong opposition from the other services, the Office of the Secretary of Defense (OSD) has offered the Army a competitive recruiting edge with special enlistment incentives for the Army only [Ref. 13: p. 8].

While the trends discussed above do not directly affect the manning option decision for the AO-177 class fleet oiler at this time, they could in the future. As stated previously, the Navy is expected to expand during this decade with an attending need for higher numbers of recruits. Any personnel shortages could lead to a reevaluation of the manning option decision for the AO-177 class fleet oiler.

3. Training Platform Requirement for AOE/AOR's

Before the Senate Armed Services Committee on 5 March 1981, a Navy representative was asked what effect the use of civilian crews on fleet support ships would have on the Navy's ability to provide logistics support to its fleet during peacetime and wartime. In response to this question the Navy representative stated:

> "In peacetime when sustainability and the fastest possible transfer of product is not critical, manning shuttle ships with civilian crews fully trained in underway replenishment has essentially only one drawback; that is, a reduction in the number of Navy personnel experienced in underway replenishment. Reducing this experience base reduces the number of experienced Navy personnel that can be used to react to expanding support requirements that could be experienced in wartime. In wartime Navy manned support ships can provide faster transfers of product and for longer periods of time. Sustainability is particularly important in the case of station ships since they are the units that transfer

products to most of the combatants. Additionally, as station ships they must be manned with personnel who are experts at battle group operations. Only military personnel meet this criteria." [Ref. 2]

The station ships to which the Navy representative referred are the AOE/AOR multi-product ships which operate as integral parts of CVBG's or BB SAG's. Due to the complexity of the underway replenishment equipment and methods used by these ships it is imperative that the Navy retains an adequate number of Navy personnel experienced in underway replenishment. The AO-177 class fleet oiler represents a modern, minimally-manned replenishment ship similarly equipped as the larger AOE/AOR station ships. Subsequently it is very strongly felt within the Navy that the five AO-177 class fleet oilers should be military manned to retain an adequate training platform for the station ships and an acceptable level of expertise in underway replenishment in the Navy.

VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The objective of this thesis has been to develop comparative life cycle costs associated with the Navy military and Navy-conversion to civil service manning options for the AO-177 class fleet oiler. An effectivness model fixed about the projected operational capabilities of the AO-177 class fleet oiler was used to determine both Navy and civil service plus Mildet manpower requirements for the ship. These manpower requirements were presented for both manning options in Chapter III.

To complete a baseline cost analysis certain conditions first had to be set. The personnel, operations and maintenance components of total annual costs were all derived using FY 81 dollars as a base. The total annual costs for each manning option were then discounted over a thirty year life using mid-year discount factors corresponding to a ten percent discount rate to derive comparative life cycle costs for each manning option of the AO-177 class fleet oiler. A cumulative cost comparison of the manning options was then presented graphically.

In that total annual costs drive life cycle costs to a very great extent, a comparison of total annual costs for each manning option was conducted. This comparison revealed

that the primary difference between total annual costs lay almost exclusively in the maintenance cost element. While it was not the intent of this study to evaluate either the Navy or MSC maintenance policies, from just a cursory comparison the Navy maintenance policy appears to be considerably different from that of MSC's. In that several Navy and Navy-converted to MSC ships over thirty years of age are operating today, this different Navy maintenance policy may be warranted.

The baseline cost analysis produced thirty year life cycle costs for each manning option. This baseline analysis assumed a four year overhaul cycle for the Navy military manning option, and that any conversion to the civil service manning option would take place during the first overhaul, after four years of operation by the Navy. It was also assumed that reconfiguration would take twelve months. The result of the baseline cost analysis was that the Navy military-conversion to civil service manning option is somewhat less costly than the Navy military manning option. This result could not be considered conclusive, however, due to the variability of some of the cost elements making up the total annual cost structure. It therefore became necessary to examine life cycle cost sensitivity to cost element variability.

The baseline cost analysis also presented comparative cumulative costs of each manning option graphically. In

this illustration of cumulative costs the manning option cumulative cost lines crossed, indicating that with a sufficiently large discount rate the relative life cycle costs derived for each manning option would reverse. It therefore also became necessary to examine the sensitivity of life cycle costs to discount rate. This life cycle cost sensitivity to both cost element variability and discount rate was examined in Chapter V along with presentation of other non-quantifiable factors which would greatly affect a manning option decision for the AO-177 class fleet oiler.

As stated previously, the baseline cost analysis necessarily established certain assumptions to serve as a framework within which cost analysis could be conducted. These initial assumptions also tended to introduce an unknown degree of bias into the analysis due to limitations in the costing data available for the study. These potentially biased cost elements therefore had to be identified and examined. In Chapter V, life cycle costs were initially examined for sensitivity to the FY 82 military pay increase, an eight year overhaul cycle, and an increase in operations tempo. These particular cost element changes were made so that the cost elements would reflect changes that have been observed since FY 81. Manning option life cycle costs were sensitive to these particular cost element changes, both when applied individually and simultaneously; however, in all cases, the Navy conversion to civil service manning

option remained the least costly of the two manning options considered.

Life cycle cost sensitivity to the different MSC maintenance policy was also examined. While substitution of the MSC maintenance policy for the Navy maintenance policy reduced the life cycle costs for both manning options, the results favored the Navy military manning option to a much greater degree. In this case the Navy military manning option life cycle costs were less than those of the other option. If the MSC maintenance policy were adequate to maintain a naval ship over a thirty year life, then this indicates a potential for life cycle cost savings for naval ships.

Life cycle cost sensitivity to the discount rate was also examined in Chapter V. It was discovered that at approximately a twelve percent discount rate the relative baseline life cycle costs reverse, and in the case of the life cycle costs incorporating the three cost element changes simultaneously, the relative manning option life cycle costs reverse at approximately an eleven percent discount rate. This significant degree of life cycle cost sensitivity to variable discount rates is noteworthy.

While life cycle cost analysis does present a quantifiable comparison of the two manning options for the AO-177 class fleet oiler, a manning option decision based on life

cycle costs alone would ignore other very important non-quantifiable factors which must also be considered. The three non-quantifiable factors analyzed in this study were Navy fleet oiler force level requirements, the expected recruiting environment during this decade, and the requirement of a training platform for the AOE/AOR multi-product replenishment ships.

The AO-177 class fleet oiler was initially put into service as a Navy operated ship partly because any delay in delivery of this class of ship for conversion to civil service specifications would have degraded an already restricted oiler force level. The Navy and MSC fleet oiler force will number seventeen units by the end of FY 82, which is three units below that recommended in the UNREP 84 study prior to the envisioned naval expansion. Even higher oiler force levels were recommended in the UNREP 88 study, commensurate with the added replenishment requirements of the CVBG's and BB SAG's. Any future decision to remove the AO-177 class fleet oiler from service to effect conversion to civil service specifications will have to weigh the required Navy fleet oiler force level consideration very heavily.

The second non-quantifiable factor examined was the expected recruiting environment during this decade. Various domestic trends indicate that not only will the overall 17-21 year old male population decrease significantly during

this decade, but that also English language comprehension among many youth could become a major problem for the Navy. These trends combined with an expected greater degree of competition from business and institutions of higher learning for high quality high school diploma graduates could lead to a shortage of personnel in the Navy by the end of this decade. Any significant personnel shortage could force a reevaluation of the manning option chosen for the AO-177 class fleet oiler regardless of cost.

The final non-quantifiable factor discussed in this study was the requirement for a training platform for the AOE/AOR multi-product replenishment station ships. Only military-manned station ships are capable of meeting the replenishment needs of a CVBG. The AO-177 class fleet oiler represents a modern, minimally-manned replenishment ship similarly equipped as the larger station ships. Therefore it is very strongly felt within the Navy that the AO-177 class fleet oiler remain military manned to serve as a training platform for the multi-product AOE/AOR station ships.

B. CONCLUSIONS

There appears to be no clear economic advantage for the Navy-conversion to civil service manning option despite the apparently lesser life cycle costs of this manning option. Comparative life cycle costs of both manning options remain

very close even after several individual and simultaneous cost element changes. In addition, the inherent weaknesses of the baseline costing data sources introduce a degree of softness into the life cycle costs derived in Chapter IV. Also significant is the life cycle cost sensitivity to the discount rate. Due to the heavy front end cost of reconfiguration, the later year annual cost savings attributable to the civil service manning option are overshadowed in the discounting process. In the baseline cost analysis a ten percent discount rate was used. If, in actuality, a discount rate of over twelve percent accurately reflected economic conditions, the Navy military manning option would be the least costly. This degree of sensitivity to discount rate further illustrates the effect that the front end costs of Navy military operation and reconfiguration have on the Navy military-conversion to civil service manning option for the AO-177 class fleet oiler. It can therefore also be concluded that any manning option decision concerning fleet support ships in general should be made prior to commencement of construction in order to avoid the front end cost of a delayed reconfiguration.

Although no conclusions about the adequacy of either the Navy or MSC maintenance policies can be drawn, it can be concluded that differences exist between the MSC and Navy maintenance policies. This difference should be the subject of further research.

As already stated, the life cycle cost analysis revealed no clear economic advantage in the case of either manning option. The non-quantifiable factors, therefore, become the dominant elements of any manning option decision concerning the AO-177 class fleet oiler. Given current manning levels within the Navy, it can be concluded that the factors favoring a Navy military manned AO-177 class fleet oiler outweigh those opposing it. The necessity for a Navy manned AO-177 class fleet oiler to serve as a training platform for the AOE/AOR multi-product station ships cannot be overemphasized in a period of naval expansion and the attendant need for replenishment support of CVBG's and BB SAG's. Given the UNREP 84 fleet oiler force level requirements, current fleet oiler force levels indicate the need to avoid the removal from service of any AO-177 class fleet oilers for conversion if no clear economic advantage can result therefrom. Those factors favoring a Navy manned AO-177 class fleet oiler could be overshadowed later in this decade, however, if the Navy experiences significant personnel shortages. Conversion of the AO-177 class fleet oilers might then become a necessity for the Navy to maintain an adequate operational fleet oiler force level.

C. RECOMMENDATIONS

The primary factors opposing conversion of the AO-177 class fleet oiler to MSC civil service manning are the time

and cost of reconfiguration, and the associated loss to the Navy of a station ship training platform. Whereas the front end cost of reconfiguration offsets any later cost savings, the time required for reconfiguration would place an additional heavy burden on an already strained fleet oiler force. The loss of a station ship training platform would result in a reduction of the number of Navy personnel experienced in underway replenishment. It is therefore recommended that the AO-177 class fleet oiler continue to be manned by Navy military personnel.

Any future fleet oiler manning option decision should be made in the context of the cost and non-quantifiable factors discussed. Each factor should be properly weighted according to the particular circumstances of the time. In the near future, assuming that the AO-177 class fleet oilers remain Navy military manned and that the Navy's station ship training platform needs are therefore satisfied, it is recommended that the next class of fleet oilers be built and operated completely as MSC civil service manned oilers. This would not only reduce the strain on the fleet oiler force by introducing new units into it, but would also require only minimal Navy personnel resources in a time of possible recruiting shortfalls. However, it is apparent that the long run force structure for fleet oilers should be a mix of both Navy military manned and civil service manned vessels. It is further recommended that in the case of all future fleet

oilers, the manning option decision be made prior to the commencement of construction. This would reduce delays in delivery, eliminate time-consuming, costly, and wasteful reconfigurations, and ultimately ease the burden of already operational fleet oiler assets.

While it was not the intent of this study to evaluate either the Navy or MSC maintenance policies, it is recommended that a comparative analysis of them be conducted. A study of current Navy maintenance policy might result in changes that could produce potentially significant life cycle cost savings not only for the AO-177 class fleet oiler, but also for any class of ship.

APPENDIX A

NAVY AND MILITARY DETACHMENT BILLET COSTS

The grade and rating breakdown for the Navy military manning of the AO-177 class fleet oiler are as shown in Table A-1. The manning levels shown in this breakdown are in accordance with the PSMD. The billet cost of each grade or rating was derived from the FY 81 Navy Billet Cost Model. This billet cost for one year was multiplied by the manning level of each grade or rating to determine that particular annual billet cost. These billet costs were then summed to find the total annual billet cost of manning an AO-177 class fleet oiler with a Navy military crew. The same method as described above was used to derive the military detachment billet cost. The grade and rating breakdown for the military detachment is also as shown in Table A-1.

TABLE A-1

Navy/Mildet Billet Cost

Grade/ Rating	Manning Level	1 Year Billet Cost	Total Annual Cost
OFFICERS:			
O-5	1	43,953	43,953
O-4	1	37,764	37,764
O-3	3	29,631	88,893
O-2	4	24,217	96,868
O-1	1	24,400	24,400
W-3	2	33,264	66,528
EXECUTIVE DEPARTMENT:			
X DIVISION			
MAC	1	24,494	24,494
JO3	1	16,164	16,164
PC3	1	15,693	15,693
PN1	1	22,394	22,394
PN3	1	15,619	15,619
YNC	1	24,995	24,995
YN3	1	16,071	16,071
IC2	1	19,016	19,016
HM1	1	22,102	22,102
N DIVISION			
QMC	1	24,885	24,885
QM1	1	21,262	21,262
QM2	1	17,599	17,599
QM3	2	15,739	31,478
QMSN	1	14,977	14,977
OPERATIONS DEPARTMENT:			
OC DIVISION			
SM1	1	24,011	24,011
SM2	1	17,562	17,562
SM3	2	15,312	30,624
SMSN	1	14,714	14,714
RMC	1	25,891	25,891
RM1	1	23,078	23,078
RM2	2	18,224	36,448
RM3	1	16,000	16,000
RMSN	2	15,066	30,132
OE DIVISION			
ET1	1	23,394	23,394
ET2	2	22,872	45,744
ET3	2	22,867	45,734

OI DIVISION			
OS1	1	22,233	22,233
OS2	2	17,241	34,482
OS3	1	15,544	15,544
OSSN	3	14,725	44,175
DECK DEPARTMENT:			
DECK DIVISION			
BMC	1	24,800	24,800
BM1	1	22,788	22,788
BM2	3	17,802	53,406
BM3	3	14,793	44,379
BMSN	7	13,932	97,524
**SN	16	13,932	222,912
3rd DIVISION			
GMG3	1	17,845	17,845
**SN	1	19,169	19,169
RASE DIVISION			
BM1	1	22,788	22,788
BM2	1	17,802	17,802
BM3	3	14,793	44,379
BMSN	3	13,932	41,796
**SN	5	13,932	69,660
EM1	1	22,344	22,344
EM2	1	19,096	19,096
EM3	1	19,202	19,202
MMC	1	25,827	25,827
MM1	1	22,723	22,723
MM2	1	19,592	19,592
MM3	2	19,035	19,035
**FN	1	18,283	18,283
ENGINEERING DEPARTMENT:			
A DIVISION			
EN1	1	22,946	22,946
EN3	1	15,029	15,029
MMC	1	25,827	25,827
MM1	1	22,723	22,723
MM2	1	19,592	19,592
MM3	4	19,035	76,140
**FN	1	18,283	18,283
MR2	1	17,619	17,619
B DIVISION			
BTC	1	26,362	26,362
BT1	2	23,176	46,352
BT2	5	17,654	88,270
BT3	3	14,908	44,724
**FN	4	13,885	55,540

E DIVISION			
EMC	1	25,521	25,521
EM1	1	22,344	22,344
EM2	2	19,096	38,192
EM3	4	19,202	76,808
IC1	1	22,417	22,417
IC2	1	19,016	19,016
IC3	1	18,138	18,138
ICFN	1	17,271	17,271
M DIVISION			
MMC	1	25,827	25,827
MM1	2	22,723	45,446
MM2	3	19,592	58,776
MM3	5	19,035	95,175
MMFN	1	18,283	18,283
**FN	6	18,283	109,698
R DIVISION			
HTC	1	25,558	25,558
HT1	1	22,642	22,642
HT2	2	17,644	35,288
HT3	2	15,503	31,006
HTFN	2	14,577	29,154
SUPPLY DEPARTMENT:			
S-1 DIVISION			
DK2	1	17,636	17,636
SH1	1	22,959	22,959
SH2	1	18,886	18,886
SH3	2	16,178	32,356
SHSN	1	15,921	15,921
**SN	1	15,921	15,921
SKC	1	25,140	25,140
SK1	1	22,891	22,891
SK2	1	18,664	18,664
SK3	1	16,237	16,237
SKSN	1	15,815	15,815
S-2 DIVISION			
MSC	1	26,440	26,440
MS1	1	24,104	24,104
MS2	2	20,688	41,376
MS3	1	15,507	15,507
MSSN	2	14,586	29,172
**FN	3	14,586	43,758
**SN	6	14,586	87,516
TOTAL NAVY BILLET COST			3,685,572

Mildet Billet Cost

Grade Rating	Manning Level	1 Year Billet Cost	Total Annual Cost
O-3	1	29,631	29,631
SM1	1	24,011	24,011
SM2	1	17,562	17,562
SM3	2	15,312	30,624
SMSN	1	14,714	14,714
RM1	1	23,078	23,078
RM2	2	18,224	36,448
RM3	1	16,000	16,000
RMSN	2	15,066	30,132
ET1	1	23,394	23,394
ET2	2	22,872	45,744
ET3	2	22,867	45,734
OS1	1	22,233	22,233
OS2	2	17,241	34,482
OS3	1	15,544	15,544
OSSN	3	14,725	44,175
BM1	1	22,788	22,788
DK2	1	17,636	17,636
TOTAL MILDET BILLET COST			493,930

**Where non-rated SN or FN appear it is assumed that their billet cost is that for an E-3 of the parent rating. A billet cost for non-rated SN or FN is not included in the Navy Billet Cost Model.

LIST OF REFERENCES

1. Office of the Chief of Naval Operations (OP-375), Memorandum: "House Appropriations Committee Hearings of 31 March 1982," 5 April 1982.

2. Office of the Chief of Naval Operations (OP-03), Memorandum: "Senate Armed Services Committee Hearings of 5 March 1981," 23 March 1981.

3. Information Spectrum, Inc., Analysis of a Study entitled Civilianization of Navy Fleet Support Ships prepared for the Joint Maritime Congress, Office of the Chief of Naval Operations (OP-96), 15 December 1980.

4. Commander, Naval Sea Systems Command (PMS 383), Fleet Oiler (AO-177 Class) Preliminary Ship Manpower Document, 18 January 1980.

5. Office of the Chief of Naval Operations (OP-375E), OPNAVINST 3501.134, Projected Operational Environment (POE) and Required Operational Capabilities (ROC) for the AO-177 Class Fleet Oiler, 21 April 1980.

6. Navy Personnel Research and Development Center, Life Cycle Navy Enlisted Billet Costs - FY 81, NPDRC SR 81-22, July 1981.

7. Navy Personnel Research and Development Center, Life Cycle Navy Officer Billet Costs - FY 81, NPDRC TR 81-12, June 1981.

8. Information Spectrum, Inc., Investigation of the Potential for Increased Use of Civilian Manning in Fleet Support Ships, Systems Analysis Division (OP-96), Office of the Chief of Naval Operations, 21 March 1978.

9. Department of the Navy, Commander Military Sealift Command, Revision of the Atlantic and Pacific Wages for MSC Mariners, Encl: 1 of ltr ser M-21 of 8 February 1982.

10. Office of the Chief of Naval Operations (OP-90P), Navy Program Factors Manual, Volume I, Revision October 1979.

11. Department of the Navy, Navy Accounting and Finance Center, NAVCOMPTNOTE 7041, Composite Standard Military Rates and Basic Allowance for Quarters Rates, 18 November 1980.

12. Department of the Navy, Navy Accounting and Finance Center, NAVCOMPTNOTE 7041, Composite Standard Military Rates and Basic Allowance for Quarters Rates, 2 December 1981.

13. Department of the Navy, Navy Recruiting Command, COMNAVCRUITCOM Headquarters Marketing Operations Plan FY 1983, Encl 1 of ltr ser 2410 of 26 May 1982.

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